

## Psy 523/623 Structural Equation Modeling Syllabus Spring 2018

### Instructor

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### Meeting Times and Location

Class: Tu-Th, 10:00 – 11:50 AM, 307 Cramer Hall. Lab sessions will be held the last hour on Thursdays (from 11:00 – 11:50 AM) in Douglas Fir Trailer 6 (south side of SW Market Street, between SW 11th Ave and SW 12th Ave) for some class periods.

### Text

Kline, R.B. (2016). *Principles and Practice of Structural Equation Modeling, Fourth Edition*. New York: Guilford. ISBN: 146252334X

### Optional Text

Bollen, K.A. (1989). *Structural equations with latent variables*. New York: Wiley. Available at the bookstore or used copies may be obtainable online. ISBN: 0471011711.

### Also Recommended (not in bookstore)

Beaujean, A. A. (2014). *Latent Variable Modeling Using R: A Step-by-Step Guide*. New York: Routledge. ISBN: 1848726996.

Geiser, C. (2012). *Data analysis with Mplus*. New York, NY: Guilford. ISBN: 1462502458.

### Prerequisites

I assume that students have taken a graduate statistics course that covers simple and multiple regression analysis, such as Psy 522/622.

### Overview

This course is intended to introduce students to structural equation modeling. Structural equation modeling (sometimes referred to as covariance structural analysis) is a regression-based technique that incorporates elements of path analysis and confirmatory factor analysis. The general goal is to provide a thorough background in the conceptual aspects, statistical underpinnings, and application of this method rather than a tutorial on a specific software package. At the end of the course, I expect students to have a solid, conceptual foundation of structural modeling issues, be able to analyze data using any SEM package, be able to critically evaluate professional articles, and be able to write up results from structural modeling analyses.

### Readings and Commentaries (10%)

There will be several readings assigned each week taken from the text and supplemental sources. The readings will often include an example article that applies SEM. Please read the material prior to class and be prepared for discussion. Students will be required to turn in a **one-page commentary** on all of the readings for that week on each Tues by 9 am via email. The commentaries should be an informal set of questions, comments, or summary information (summarize only if you cannot think of anything else to say) about the articles. The purpose of the commentaries is to make sure the class is prepared for discussion and to help me identify discussion topics and sources of confusion in the readings. I will assign 2 (complete and well-considered), 1 (did not read some/lacking effort), or 0 (did not read most/minimal effort/late/nothing) points to each, with one freebie for the quarter.

### Homeworks (90%)

There will be three homework assignments which will primarily consist of data analysis and write-ups of SEM problems using the demo version of the statistical program, Mplus (Muthen & Muthen, 1998-2017), and the lavaan package in R. Mplus and lavaan have very simple syntax, allowing us to focus more on statistical and

applied issues rather than debugging programs or other software headaches. I will also provide some examples using Amos in class and discuss other software briefly. Some data preparation and descriptive analysis using SPSS or R may be required (let me know if this will be an inconvenience for some reason). The demo version of Mplus Version 8 can be downloaded from the following internet site:

<http://www.statmodel.com/demo.shtml>. The demo version has no limitations on analysis types but allows no more than six dependent variables and two independent variables. R software is available at <http://www.r-project.org/>. Although you should not need it, the Mplus users guide can also be downloaded from the Mplus website (<http://www.statmodel.com>). The lavaan package is installed by running `install.packages("lavaan", dependencies=TRUE)` the command line. More information is available at <http://lavaan.ugent.be/>.

**Homework due dates are:** 5/1/18, 5/22/18, 6/12/18 (4 PM Mon finals week). Late assignments are not accepted without penalty (10% per day) unless there are extenuating circumstances, such as illness or family emergency. Please let me know if there are extenuating circumstances as early as possible.

### Grades

Grades are based on an average of the three homework assignments (90%) and weekly commentaries (10%). Total percentages will be assigned the following grades:  $\geq 90 = A$ ,  $85-89.9 = B+$ ,  $80-84.9 = B$ ,  $75-79.9 = C+$ ,  $70-74.9 = C$ .

### Other Resources

There are several internet sites devoted to SEM that may be of use. Dave Kenny has a great website with introductory material on most SEM topics at <http://davidakenny.net/cm/causalm.htm> (including a free pdf copy of his book, *Correlation and Causation*). Ed Rigdon has an excellent site that serves as a gateway to most of the SEM sites on the web at <http://www.gsu.edu/~mkteer/>. There is a SEM discussion list called SEMNET which you can subscribe to (I think it would be a great idea if everyone would subscribe during this term) through the following site <http://www2.gsu.edu/~mkteer/semnet.html>. The Mplus website has lots of example programs, white papers, and an Mplus discussion section <http://www.statmodel.com/>. Finally, I have compiled a list of hundreds of articles and books on SEM organized by topic at my website <http://web.pdx.edu/~newsomj/>.

### Sexual Harrassment, Sexual Violence, and Discrimination

As an instructor, one of my responsibilities is to help create a safe learning environment for my students and for the campus as a whole. Please be aware that as a faculty member, I have the responsibility to report any instances of sexual harassment, sexual violence and/or other forms of prohibited discrimination. If you would rather share information about sexual harassment, sexual violence or discrimination to a confidential employee who does not have this reporting responsibility, you can find a list of those individuals or contact a confidential advocate at 503-725-5672. For more information about Title IX please complete the required student module *Creating a Safe Campus* in your D2L.

### Disabilities

I am happy to make any necessary arrangements with students who have a disability and are in need of academic accommodations. If you have not done so already, please contact the Disability Resource Center, 116 Smith Memorial Student Union, <http://www.pdx.edu/drc/>, Email: [drc@pdx.edu](mailto:drc@pdx.edu), for assistance and any testing arrangements. I would appreciate it if you would check with me as soon as possible to discuss any needed accommodations and to make sure that I have received a faculty notification letter. If any aspects of instruction or course design result in barriers to your inclusion or learning, please let me know.

**Course Readings**  
**Psy 523/623 Structural Equation Modeling**  
**Spring 2018**

**Primary Text:** Kline, R.B. (2016). *Principles and Practice of Structural Equation Modeling, Fourth Edition*. New York: Guilford.

**Commentaries are due at 9 AM on Tuesday of each week** (second date listed in each topic section below)

**4/5,4/10 Overview and History of SEM and Matrix Algebra**

Kline, Chapter 1, "Coming of Age"

Hayduk, L.A. (1987), Chapter 3 "The New Basics" (pp. 56-77 only) in *Structural equation modeling with Lisrel: Essentials and advances*. Baltimore, MD: John Hopkins University Press.

Pedhazur, E.J. (1997). Chapter 6, "General method of multiple regression analysis: Matrix operations." In *Multiple regression in behavioral research: Explanation and prediction (3<sup>rd</sup> Edition)*. Fort Worth: Harcourt Brace.

Kenny, D.A. (1979). Chapter 2, "Covariance Algebra" in *Correlation and causation*. New York: Wiley.

*Optional Regression Review:* Kline, Chapter 2, "Regression Fundamentals"; Pedhazur, E.J. (1997). Chapter 2, "Simple linear regression and correlation" & Chapter 5, "Elements of multiple regression analysis: Two independent variables" in *Multiple regression in behavioral research: Explanation and prediction (3<sup>rd</sup> Edition)*. Fort Worth, TX: Harcourt Brace.

**4/12,4/17 Path Analysis**

Loehlin, J. (2004), *Latent Variable Models, Fourth Edition*, Chapter 1 Path Analysis (pp. 1-16, 23-28 only)

Kline, Chapter 7 "Identification of Observed-Variable (Path) Models (pp. 145-150 only).

Kline, Chapter 6 "Specification of Observed-Variable (Path) Models" (129-138 only), Appendix 6.A

*Example article:* Bryce, C. I., Goble, P., Swanson, J., Fabes, R. A., Hanish, L. D., & Martin, C. L. (2017). Kindergarten School Engagement: Linking Early Temperament and Academic Achievement at the Transition to School. *Early Education and Development*, 1-17. DOI: 10.1080/10409289.2017.1404275

*Optional article:* Fritz, M. S., Taylor, A. B., & MacKinnon, D. P. (2012). Explanation of two anomalous results in statistical mediation analysis. *Multivariate Behavioral Research*, 47, 61-87.

**4/19,4/24 Confirmatory Factor Analysis I: Theory, Model Fitting Concepts, and Software**

Loehlin, J. (2004), *Latent Variable Models, Fourth Edition*, Chapter 1 Path Analysis (pp. 16-22 only)

Kline, Chapter 9, "Specification and Identification of Confirmatory Factor Analysis Models," Appendix 9.A

Bollen, K. A. (2002). Latent variables in psychology and the social sciences. *Annual review of psychology*, 53(1), 605-634. (*Optional sections:* "Latent Variables in Limited Dependent-Variable Models," "Latent Curve Models," "Item Response Theory," and "Latent Class Analysis")

Preacher, K.J., & MacCallum, R.C. (2003). Repairing Tom Swift's electric factor analysis machine. *Understanding Statistics*, 2, 13-43

*Optional chapter:* Chapter 9 Exploratory Factor Analysis. Pituch, K. A., & Stevens, J. P. (2016). *Applied multivariate statistics for the social sciences: Analyses with SAS and IBM's SPSS*. New York: Routledge.

**4/26,5/1 Confirmatory Factor Analysis II: Model Comparisons and Fit indices**

Kline Chapter 11, Estimation and Local Fit Testing (pp. 231-239 only)

Ferron, J. M., & Hess, M. R. (2007). Estimation in SEM: A concrete example. *Journal of Educational and Behavioral Statistics*, 32, 110-120.

Kline, Chapter 12, "Global Fit Testing"

Hu, L.-T., & Bentler, P. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6, 1-55.

*Example article:* Mancini, J.A., & Marek, L.I. (2004). Sustaining community-based programs for families: Conceptualization and measurement. *Family Relations*, 53, 339-347.

**5/3,5/8 Full Structural Models I: Practical Issues, Model Modifications, & Missing Data**

Kline, Appendix 10.A

Bentler, P.M., & Chou, C.-P. (1988). Practical issues in structural modeling. In J.S. Long (Ed.), *Common problems/proper solutions* (pp.161-192). Beverly Hills, CA: Sage.

Enders, C.K. (2013). Analyzing structural equation models with missing data. In G.R. Hancock & R.O. Mueller (Eds.), *Structural equation modeling: A second course, 2nd edition* (pp.493-520). Charlotte, NC: Information Age Publishing.

*Example article:* Easterbrooks, M. A., Fauth, R. C., & Lamoreau, R. (2017). Effects of a home visiting program on parenting: Mediating role of intimate partner violence. *Journal of Interpersonal Violence*. DOI: 10.1177/0886260517736879

*Optional article:* Newman, D. A. (2014). Missing data: Five practical guidelines. *Organizational Research Methods, 17*, 372-411.

### **5/10,5/15 Full Structural Models II: Nonnormality & Categorical Variables**

Finney, S.J., & DiStefano, C. (2013). Nonnormal and categorical data in structural equation modeling. In G.R. Hancock & R.O. Mueller (Eds.), *Structural equation modeling: A second course, 2nd edition* (pp. 439-492) Charlotte, NC: Information Age Publishing.

*Example article:* de Beer, L., Rothmann Jr, S., & Pienaar, J. (2012). A confirmatory investigation of a job demands-resources model using a categorical estimator. *Psychological Reports, 111*, 528-544.

### **5/17,5/22 Multigroup Structural Models and Second-Order Factor Models**

Kline, Chapter 16, "Multiple-Samples Analysis and Measurement Invariance"

Bontempo, D. E., & Hofer, S. M. (2007). Assessing factorial invariance in cross-sectional and longitudinal studies. In A.D. Ong & M. van Dulmen (Eds.), *Handbook of methods in positive psychology* (pp. 153-175). Oxford University Press.

Thompson, M.S., & Green, S.B. (2013). Evaluating between-group differences in latent variable means. In G.R. Hancock & R.O. Mueller (Eds.), *Structural equation modeling: A second course, 2nd edition* (pp. 163-218). Charlotte, NC: Information Age Publishing.

*Example article*

Yap, S. C. Y., Donnellan, M.B., Schwartz, S.J., et al. (2014) Investigating the structure and measurement invariance of the Multigroup Ethnic Identity Measure in a multiethnic sample of college students. *Journal of Counseling Psychology, 61*, 437-446.

### **5/24,5/29 Issues of Causality and Longitudinal Modeling**

Kenny, D.A. (1979). Chapter 1, "Correlational Inference", in *Correlation and causation*. New York: Wiley.

Newsom, J.T. (2015). Chapter 4, Fundamental concepts of stability and change. *Longitudinal Structural Equation Modeling: A Comprehensive Introduction*. New York: Routledge.

Newsom, J.T. (2015). Chapter 5, Cross-lagged panel models. *Longitudinal Structural Equation Modeling: A Comprehensive Introduction*. New York: Routledge.

*Example article:* Burkholder, G.J., & Harlow, L.L. (2003). An Illustration of a Longitudinal Cross-Lagged Design for Larger Structural Equation Models. *Structural Equation Modeling, 10*, 465-486.

*Optional article:* Bollen, K.A., & Pearl, J. (2013). Eight myths about causality and structural equation models. In S.L. Morgan (Ed.), *Handbook of Causal Analysis for Social Research* (pp. 301-328), New York: Springer

*Optional chapter:* Kline, Chapter 8, "Graph Theory and the Structural Causal Model"

### **5/31,6/5 Growth Curve Models**

Kline, Chapter 15, "Mean Structures and Latent Growth Models"

Newsom, J.T. (2015). Chapter 7, Linear latent growth curve models. *Longitudinal Structural Equation Modeling: A Comprehensive Introduction*. New York: Routledge.

*Example article:* Hussong, A. M., Curran, P. J., Moffitt, T. E., Caspi, A., & Carrig, M. M. (2004). Substance abuse hinders desistance in young adults' antisocial behavior. *Development and psychopathology, 16*, 1029-1046.

### **6/7, 6/12\* Wrapping Up, Reporting, Cautions**

Kline, Chapter 18, "Best Practices in Structural Equation Modeling"

Mueller, R. O., & Hancock, G. R. (2008). Best practices in structural equation modeling. In J.W. Osborne (Ed.), *Best practices in quantitative methods* (pp. 488-508). Thousand Oaks, CA: Sage.

McCoach, D.B., Black, A.C., & O'Connell, A.A. (2007). Errors of inference in structural equation modeling. *Psychology in the Schools, 44*, 461-470.

Wolf, E. J., Harrington, K. M., Clark, S. L., & Miller, M. W. (2013). Sample size requirements for structural equation models: An evaluation of power, bias, and solution propriety. *Educational and Psychological Measurement, 73*, 913-934.

\*Tuesday, finals week